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Performance of the CMS Pixel detector for the Phase I upgrade at HL-LHC

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The luminosity upgrade of the Large Hadron Collider is foreseen to proceed in two phases. An eventual factor-of-ten increase in LHC statistics will have a major impact in the LHC Physics program. However, the HL-LHC as well as offering the possibility to increase the physics potential will create an extreme operating environment for the detectors, particularly the tracking devices and the trigger system. An increase in the number of minimum-bias events beyond the levels envisioned for design luminosity creates the need to handle much higher occupancies and for the innermost layers unprecedented levels of radiation. This can degrade the performance of the current detector. In order to recover and improve the current level of seeding, tracking, and b-tagging performance an upgrade of the CMS pixel detector system has been proposed for the Phase I of the HL-LHC. Results of Monte Carlo simulation studies for the new pixel detector will be presented and compared to that of the current CMS detector. The upgraded pixel system will provide improved b-tagging, pixel track seeding and stand-alone tracking capabilities, which will be key elements of many CMS physics analyses at the HL-LHC. In particular the upgrades will enhance CMS physics reach in exploring the Higgs sector where b-jets and tau-leptons are often produced in association with the Higgs boson or in its decays.

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